



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application Serial No. .... 09/653,149  
Filing Date ..... August 31, 2000  
Inventor ..... Garo J. Derderian, et al  
Assignee ..... Micron Technology, Inc.  
Group Art Unit ..... 2818  
Examiner ..... T. Le  
Attorney's Docket No. .... MI22-1330  
Title: Capacitor Fabrication Methods and Capacitor Constructions

**PRELIMINARY AMENDMENT TO ACCOMPANY RCE FILING**

To: Attn: Art Unit 2818  
Assistant Commissioner for Patents  
Washington, D.C. 20231

From: James E. Lake (Tel. 509-624-4276; Fax 509-838-3424)  
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**AMENDMENTS**

**In the Claims**

Please replace claims 43 and 44 with the following clean version of the amended claims and add new claims 48-75, in accordance with 37 C.F.R. § 1.121(c)(1)(i). Cancel all previous versions of any amended claim.

A marked up version showing amendments to any claims being changed is provided in one or more accompanying pages separate from this amendment in accordance with 37 C.F.R. § 1.121(c)(1)(ii). Any claim not accompanied by a marked

up version has not been changed relative to the immediate prior version, except that marked up versions are not being supplied for any added claim or canceled claim.

43. (amended) The method of claim 40 wherein the conductive layer is formed on the first electrode, further comprising chemisorbing additional alternating first and second precursor layers before forming the dielectric layer.

44. (amended) The method of claim 40 wherein the conductive layer comprises elemental metal, a metal alloy, or a metal containing compound.

48. (new) The method of claim 1 wherein the substrate comprises a semiconductive wafer.

49. (new) The method of claim 1 wherein the first capacitor electrode comprises HSG polysilicon.

50. (new) The method of claim 49, wherein the atomic layer deposited barrier layer comprises TiN and the first capacitor electrode further comprises the TiN.

51. (new) The method of claim 1 wherein the atomic layer deposited barrier layer comprises TiN.

52. (new) The method of claim 1 wherein the capacitor dielectric layer comprises  $\text{Al}_2\text{O}_3$ .

53. (new) The method of claim 1 wherein the second capacitor electrode comprises TiN.
54. (new) The method of claim 1 wherein the first capacitor electrode comprises HSG polysilicon, the atomic layer deposited barrier layer comprises TiN, the capacitor dielectric layer comprises  $\text{Al}_2\text{O}_3$ , and the second capacitor electrode comprises TiN.
55. (new) The method of claim 13 wherein the substrate comprises a semiconductive wafer.
56. (new) The method of claim 13 wherein the first capacitor electrode comprises HSG polysilicon.
57. (new) The method of claim 56, wherein the barrier layer comprises TiN and the first capacitor electrode further comprises the TiN.
58. (new) The method of claim 13 wherein the barrier layer comprises TiN.
59. (new) The method of claim 13 wherein the capacitor dielectric layer comprises  $\text{Al}_2\text{O}_3$ .
60. (new) The method of claim 13 wherein the second capacitor electrode comprises TiN.

61. (new) The method of claim 13 wherein the first capacitor electrode comprises HSG polysilicon, the barrier layer comprises TiN, the capacitor dielectric layer comprises  $\text{Al}_2\text{O}_3$ , and the second capacitor electrode comprises TiN.
62. (new) The method of claim 34 wherein the substrate comprises a semiconductive wafer.
63. (new) The method of claim 34 wherein the first capacitor electrode comprises HSG polysilicon.
64. (new) The method of claim 63, wherein the atomic layer deposited conductive layer comprises TiN and the first capacitor electrode further comprises the TiN.
65. (new) The method of claim 34 wherein the atomic layer deposited conductive layer comprises TiN.
66. (new) The method of claim 34 wherein the capacitor dielectric layer comprises  $\text{Al}_2\text{O}_3$ .
67. (new) The method of claim 34 wherein the second capacitor electrode comprises TiN.
68. (new) The method of claim 34 wherein the first capacitor electrode comprises HSG polysilicon, the atomic layer deposited conductive layer comprises TiN, the capacitor dielectric layer comprises  $\text{Al}_2\text{O}_3$ , and the second capacitor electrode comprises TiN.

69. (new) The method of claim 40 wherein the substrate comprises a semiconductive wafer.
70. (new) The method of claim 40 wherein the first capacitor electrode comprises HSG polysilicon.
71. (new) The method of claim 70, wherein the conductive layer comprises TiN and the first capacitor electrode further comprises the TiN.
72. (new) The method of claim 40 wherein the conductive layer comprises TiN.
73. (new) The method of claim 40 wherein the capacitor dielectric layer comprises  $\text{Al}_2\text{O}_3$ .
74. (new) The method of claim 40 wherein the second capacitor electrode comprises TiN.
75. (new) The method of claim 40 wherein the first capacitor electrode comprises HSG polysilicon, the conductive layer comprises TiN, the capacitor dielectric layer comprises  $\text{Al}_2\text{O}_3$ , and the second capacitor electrode comprises TiN.



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Examiner ..... T. Le  
Attorney's Docket No. .... MI22-1330  
Title: Capacitor Fabrication Methods and Capacitor Constructions

**RESPONSE TO FEBRUARY 27, 2002 OFFICE ACTION**

To: Attn: Art Unit 2818  
Assistant Commissioner for Patents  
Washington, D.C. 20231

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**AMENDMENTS**

**In the Claims**

Please add new claims 34-47, in accordance with 37 C.F.R. § 1.121(c)(1)(i). A  
marked up version showing amendments is not required.

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34. (new) A capacitor fabrication method comprising:
- forming a first capacitor electrode over a substrate, the first electrode comprising silicon;
  - atomic layer depositing a metal-containing conductive layer over the first electrode;
  - forming a capacitor dielectric layer over the first electrode; and
  - forming a second capacitor electrode over the dielectric layer.
35. (new) The method of claim 34 wherein the atomic layer deposited conductive layer is formed on the first electrode.
36. (new) The method of claim 34 wherein the atomic layer deposited conductive layer comprises elemental metal, a metal alloy, or a metal-containing compound.
37. (new) The method of claim 34 wherein the atomic layer deposited conductive layer comprises WN, WSiN, TaN, TiN, TiSiN, Pt, Pt alloys, Ir, Ir alloys, Pd, Pd alloys, RuO<sub>x</sub>, or IrO<sub>x</sub>.
38. (new) The method of claim 34 wherein at least one of the first or second electrodes comprise polysilicon and the dielectric layer comprises oxygen.
39. (new) The method of claim 34 wherein the dielectric layer comprises Ta<sub>2</sub>O<sub>5</sub>, ZrO<sub>2</sub>, WO<sub>3</sub>, Al<sub>2</sub>O<sub>3</sub>, HfO<sub>2</sub>, barium strontium titanate, or strontium titanate.

40. (new) A capacitor fabrication method comprising:

forming a first capacitor electrode over a substrate, the first electrode comprising silicon;

chemisorbing a layer of a first precursor at least one monolayer thick over the first electrode;

chemisorbing a layer of a second precursor at least one monolayer thick on the first precursor layer, a chemisorption product of the first and second precursor layers being comprised by a layer of a metal-containing conductive material;

forming a capacitor dielectric layer over the first electrode; and

forming a second capacitor electrode over the dielectric layer.

41. (new) The method of claim 40 wherein the first and second precursor layers each consist essentially of a monolayer.

42. (new) The method of claim 40 wherein the first and second precursors respectively comprise only one of the following pairs:  $\text{WF}_6/\text{NH}_3$ ,  $\text{TaCl}_5/\text{NH}_3$ ,  $\text{TiCl}_4/\text{NH}_3$ , tetrakis(dimethylamido)titanium/ $\text{NH}_3$ , ruthenium cyclopentadiene/ $\text{H}_2\text{O}$ ,  $\text{IrF}_5/\text{H}_2\text{O}$ , organometallic Pt/ $\text{H}_2\text{O}$ .

43. (new) The method of claim 40 wherein the atomic layer deposited conductive material is formed on the first electrode, further comprising chemisorbing additional alternating first and second precursor layers before forming the dielectric layer.



44. (new) The method of claim 40 wherein the atomic layer deposited conductive material comprises elemental metal, a metal alloy, or a metal containing compound
45. (new) The method of claim 40 wherein the conductive material comprises WN, WSiN, TaN, TiN, TiSiN, Pt, Pt alloys, Ir, Ir alloys, Pd, Pd alloys, RuO<sub>x</sub>, or IrO<sub>x</sub>.
46. (new) The method of claim 40 wherein at least one of the first or second electrodes comprises polysilicon and the dielectric layer comprises oxygen.
47. (new) The method of claim 40 wherein the dielectric layer comprises Ta<sub>2</sub>O<sub>5</sub>, ZrO<sub>2</sub>, WO<sub>3</sub>, Al<sub>2</sub>O<sub>3</sub>, HfO<sub>2</sub>, barium strontium titanate, or strontium titanate.

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Examiner ..... T. Lee  
Attorney's Docket No. .... MI22-1330  
Title: Capacitor Fabrication Methods and Capacitor



**RESPONSE TO MAY 16, 2001 OFFICE ACTION**

To: Box NON FEE AMENDMENT  
Assistant for Patents and Trademarks  
Washington, D.C. 20231

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**AMENDMENTS**

**In The Claims**

Please cancel claims 26-33 without prejudice

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